

Trauma - Nekudot

- Hypotension - in a trauma assumed due hypovolemia until proved otherwise; Dx: FAST;
- Rapid-sequence intubation - 3m of O2 via bag-valve-mask → in-line cervical stabilization, cricoid pressure, Rx paralytic/induction (etomidate) → laryngoscopy → intubation;
 - Rx via ETT - (NAVEL) naloxone, atropine, ventolin (salbutamol), epi, lidocaine;
- Focused Abdominal Sonography For Trauma (FAST) - secondary survey; ✓ four areas: pericardial window (subxiphoid), hepatorenal space (Morison's pouch; right midaxillary line, between 11-12 ribs), splenorenal space (right post axillary line, between 9-11 ribs), pouch of Douglas (3 cm above symphysis on full bladder);

Chest trauma

- ED thoracotomy - indications: blunt/penetrating chest trauma in pts who lose their vital si in transport/ED;
- Tension pneumothorax - clinic: ↓ breath sounds, shock; P/E: collapsed ipsilateral lung, mediastinum → contralateral shift, contralateral lung compression; Tx: large-gauge needle into 2nd intercostal at midclavicular line → chest tube;
- Hemothorax - Tx: chest tube; If bleeding ≥ 1500 mL initially, at 200 mL/h for 4 h, at 100 mL/h for 8 h → exploratory thoracotomy
- Pericardial effusion - Dx: ECHO;
- Cardiac injury - Dx: ECG, ECHO (if unstable/arrhythmias), FAST (r/o tamponade), troponin;
 - Cardiac tamponade - clinic: Beck's triad (hypotension, JVD, muffled heart sounds); Dx: ECHO; Tx: stable - pericardiocentesis/subxiphoid drainage in OR; unstable - ED/OR thoracotomy;
 - Cardiac contusions (blunt trauma) - RV MC involved; clinic: arrhythmias;
- Aortic injury - clinic: CXR si - widened mediastinum (>8 cm), main bronchus/tracheal deviation, aortic knob, apical caps; Dx: CT angio; Tx: surgery (descending aortic → left posterolateral thoracotomy; ascending aorta → median sternotomy);
- Esophageal injury - Dx: esophagoscopy, barium swallow;
- Diaphragmatic injury - clinic: penetrating site below the nipples; Dx: CXR (40% nml) air-fluid level + NG tube coiling upward into the chest → laparoscopy; Tx: laparotomy;
- Flail Chest - ≥3 ribs w/ 2 frx sites; clinic: paradoxical breathing, inspiration → weaker pulse; Tx: analgesia, physiotherapy, if resp. Sx → PPV and PEEP PRN (let ribs heal on their own);
- Incentive spirometry - pts can ✓ tidal volume and will have an “incentive” to increase it;

abd trauma

- Diagnostic Peritoneal Lavage (DPL) - ⊕: ≥10 cc of blood, >100,000/μL RBC, >500/μL WBC, ↑ amylase, ↑ bilirubin, ↑ ALP; if ⊕ → exploratory laparotomy;
- Blunt abd trauma - prevalence: spleen > liver > kidney > small bowel > bladder;
- Penetrating abd trauma - prevalence: liver > small bowel > stomach, colon, spleen; Dx: laparoscopy;
- Retroperitoneal hematomas
 - Cullen’s sign - periumbilical area bluish discoloration; retroperitoneal hemorrhage → anterior abd wall via fascial planes (acute hemorrhagic pancreatitis);
 - Fox’s sign - ecchymosis of inguinal lig;
 - Grey Turner’s sign - flank ecchymosis;

Zone	Location	Assoc injury	Tx
1	midline retroperitoneum (divided by transverse mesocolon into supra-/inframesocolic seg)	pancreatico-duodenal, major abd vessels	All injuries should be explored
2	flank or perinephric spaces	genitourinary system, colon;	explored only if penetrating MOI
3	pelvic retroperitoneum	pelvic frx, iliac-femoral vascular	explored only if penetrating MOI; frx fixation, angio embolization;

- Seatbelt si - Ecchymosis on lower abd from wearing a seatbelt (~10% of patients w/ this si have a small bowel perforation!); ; ⊖ Dx → observe;
- Hollow viscus injury - Dx: CT - free air, wall thickening (bowel or mesentery), free fluid; ⊕ DPL → exploratory laparotomy;
 - Bowel injuries - <50% circumferential + stable → primary repair; >50% → resection + anastomosis;
 - Duodenal hematomas - clinic: proximal SBO, abd pain, ± RUQ mass; Dx: upper GI series - duodenum - coiled spring si; Tx: NG suction + observation (resolve spontaneously w/i 7-15 d), if exploration → drainage;
 - Duodenal rupture - Dx: gastrografin study.
- Liver injury
 - Hemobilia - connection between biliary-arterial systems; clinic: RUQ pain, melena, jaundice; Dx: CT w/ contrast, upper endoscopy; Tx: angio w/ embolization;
 - Hepatic necrosis/abscess - clinic: RUQ pain, fever, leukocytosis, ± peritonitis; Dx: CT w/ contrast (nonperfused parenchyma ± fluid collection); Tx: laparotomy w/ debridement
 - Biloma - leakage of bile; Tx: percutaneous drainage ± ERCP (biliary stents, sphincterotomy → ↓ intrahepatic biliary pressure);
- Common bile duct injury - complete transection: unstable → T tube + staged repair; stable w/ tissue loss → biliary enteric bypass (Roux-en- Y choledochojejunostomy, cholecystojejunostomy); stable w/o tissue loss, lacerated, partially transected→ primary end-to-end repair;
- Pancreatic injury - Dx: ✓ amylase → CT, ERCP; Tx: No ductal dmg → hemostasis + external drainage; distal transection (left to mesenteric vessels), parenchymal injury w/ ductal injury → distal pancreatectomy w/ duct ligation + proximal stump drainage; devitalized duodenum/pancreatic head → Whipple/total pancreatectomy;
- Spleen injury - clinic: hemoperitoneum, Kehr’s sign (Left shoulder pain = splenic rupture), LUQ pain, Ballance’s sign (LUQ dullness); Dx: stable → CT; unstable → FAST/DPL; Tx: surgery indications: adequate resuscitation → unstable, transfusion, peritonitis, failure of nonoperative Tx;

	Grade	Injury Description
I	Hematoma	Subcapsular, <10% of surface area
	Laceration	Capsular tear, <1 cm in parenchymal depth
II	Hematoma	Subcapsular, 10% to 50% of surface area; intraparenchymal, <5 cm in diameter
	Laceration	1-3 cm in parenchymal depth and does not involve a trabecular vessel
III	Hematoma	Subcapsular, >50% of surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma >5 cm or expanding
	Laceration	>3 cm in parenchymal depth or involving a trabecular vessel
IV	Laceration	involving the segmental or hilar vessels and producing major devascularization (>25% of spleen)
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury that devascularizes the spleen

- Abdominal Compartment Syndrome - postop/massive IVF → ↑ intraabd pressure (> 25 mmHg); tight/distended abd, ↓ UOP, ↑ airway/intraabd pressure, ↑ CVP, ↓ venous return → ↓ CO, ↑ PCWP; Tx: drain ± decompressive laparotomy (leaving fascia open);

Urology

- Urethral injuries - clinic: perineal pain, inability to void, hematuria, blood at the urethral meatus, perineal/scrotal swelling/ecchymosis, absent prostate; Dx: retrograde urethrogram; Tx: bladder decompression + drainage (partial tears → bridging transurethral catheter; complete disruption → suprapubic cystostomy)
- Bladder injury - Dx: retrograde cystogram;

ENT

- Neck trauma
 - Selective exploration - based on Dx studies: A-gram, CT A-gram, bronchoscopy, esophagoscopy;

Zone	Def	penetrating injuries Tx
III	Above and at mandible <	angiography, triple endoscopy (tracheobroncho-/ esophagoscopy), selective exploration;
II	Between mandible < - cricoid cartilage	angio, triple endoscopy; surgical vs. selective exploration
I	Below cricoid cartilage	aortography, selective exploration;

- Formal neck exploration - absolute indications (“Hard si”):
 - Acute si of airway distress - stridor, hoarseness, dysphonia;
 - Visceral injury - subcutaneous air, hemoptysis, dysphagia
 - Hemorrhage - expanding hematoma, unchecked external bleeding
 - Neurologic Sx (carotid injury) - stroke, altered mental status
 - lower cranial nerve or brachial plexus injury;
 - unstable; penetrating neck wound;
- Carotid dissection - if no neuro Sx → Tx: heparin;
- Carotid artery injury - if stable, no complete occlusion → repair;

Orthotrauma

- Vascular injury
 - Venous damage - Tx: unstable → ligation; stable → repair (suture closure, saphenous vein patches, synthetic interposition grafts)
 - Acute arterial insufficiency - Clinic: “hard si”, “soft si”, pain, paresthesias + paralysis (=ischemia), pallor, pulselessness (The 5 P’s); Tx: Immediate exploration + repair (w/in 6-8 h, later = irreversible ischemia);
 - “Hard si” - expanding hematoma, pulsatile bleeding, audible bruit, palpable thrill, absent distal pulses or distal ischemia;
 - “Soft si” - hypotension/shock, Hx of hemorrhage at the scene, peripheral nerve deficit, stable hematoma, proximity to major vessel;
- Compartment syndromes - assoc.: humerus supracondylar/tibial shaft frx, pos knee dislocations (popliteal artery injury); clinic: (4 P’s) pain, paresthesia, pallor, pulselessness, poikilothermia; dx: ✓ pressure w/i compartment → if > 30 mmHg → fasciotomy (four compartments below the knee); complication: 8 h → irreversible dmg;
 - Forearm frx cast related - clinic: fingers passive movement → pain, ± paresthesias; Tx: cast cleaving + limb elevation → ↓ edema;
 - Volkmann’s ischemic contracture - clinic: hyperkalemia, myoglobinuria → AKI;
- Rhabdomyolysis - myoglobinuria → ATN; labs: urine - ⊕ myoglobin, ⊖ RBCs, ↑ CPK, nml serum haptoglobin; Tx: maintaining UOP 100 mL/hr; IV NaHCO3 (urine alkalinization) ± mannitol;
- Scaphoid bone frx - clinic: snuffbox tenderness; Dx: ± ⊖ x-ray; Tx: wrist cast, repeat x-ray in 10–14 d;
- Median nerve injury - motor: pronators of the forearm, thenar muscles (can’t flex 1-3 digits); sensory: palm, 1-3 fingers;
- Unstable pelvic frx - initial mgmt: pelvic binding apparatus
- Achilles tendon rupture - Dx: thompson test (failure of plantar flexion after squeezing the gastrocnemius)
- Plantar fasciitis - Etio: weight bearing, high BMI; clinic: pain on the underside of the heel; Dx: clinical, Heel Rg - heel spur (bony calcification on the calcaneus); Tx: conservative;

Burns

- Burn center - <10 yrs or >50 yrs; burns >20% BSA, 3° burns >5% BSA, coexisting chemical/electrical injury, facial burns, genitalia, perineum, hands, feet, preexisting dz;
- Fluid resuscitation - Parkland formula = TBSA x weight x 4; ½ in first 8 h (NB! divide by 8), ½ over next 16 h (NB! divide by 16); LR; UOP 30-50cc (titer IVF);

Radiation exposure

Load	Clinic
<1 Gy	aSx, 0% mortality;
1-4 Gy	Hematopoietic syndrome (48 h postexposure → pancytopenia)
8-12 Gy	>8 Gy 100% mortality; GI syndrome - N/V → 1-2 w, bloody diarrhea & death;
>15 Gy	Neurovascular syndrome - massive vasodilation → shock & death;

Toxicology

Toxin	clinic	Tx
Anticholinergic	etio: atropine, antihistamines, scopolamine, drugs, plants (deadly nightshade, jimsonweed); “dry as a bone, mad as a hatter, blind as a bat, hot as a hare, full as a flask, heart runs alone” (no sweat, delirium, mydriasis, fever, urinary retention, tachy); “can’t pee, can’t see, can’t spit, can’t shit”;	physostigmine
β-Blocker	bradycardia, hypotension;	glucagon
Carbon monoxide	headache, N/V, confusion, coma, cherry-red skin, carboxy-hemoglobin (bright red); GPI hypodensity on CT	100% O ₂ ± hyperbaric O ₂ ;
Ethylene glycol	Ca-oxalate crystals in urine, AG metabolic acidosis w/ high Sosm;	fomepizole/ethanol;
Iron	vomiting, bloody diarrhea, acidosis, CXR → radiopaque tablets;	<u>d</u> eferoxamine;
Lead	microcytic anemia w/ basophilic stippling, ataxia, retardation, peripheral neuropathy;	EDTA, dimercaprol;
Magnesium sulfate	Acts as CCB on the ❤️ → arrhythmias (cardiac arrest); other: hypotension, weakness, N/V, bradypnea;	Calcium gluconate

Organophosphate	incontinence, cough, bronchospasm, miosis, bradycardia, heart block, tremor;	atropine, pralidoxime;
Phenobarbital	CNS depression, hypothermia, miosis, hypotension;	charcoal, Na bicarbonate + fluids (urine alkalinization)
Thiazide Toxicity	("HyperGLUC") hyperGlycemia, hyperLipidemia, hyperUricemia, hyperCalcemia; hypokalemic metabolic alkalosis, hyponatremia, sulfa allergy;	
Tricyclic antidepressants (TCA)	anticholinergic Sx, QRS >100 ms, tachy, coma;	bicarbonate bolus;

Bites and Stings

	Clinic	Tx	C/B
Snake (rattlesnake, copperhead, water moccasin, coral snake)	Pain and swelling at bite, progressive dyspnea, toxin-induced DIC	Immobilize extremity and cleanse wound; antivenin likely required	Effects more severe in children; increased mortality without prompt treatment
Scorpion	Severe pain and swelling at site of sting, increased sweating, vomiting, diarrhea	Antivenin, atropine, phenobarbital	Acute pancreatitis, myocardial toxicity, respiratory paralysis
Spider			
Black widow	Muscle pain and spasms, localized diaphoresis, abdominal pain, autonomic stimulation	Local wound care, benzodiazepines, antivenin	Ileus, cardiovascular collapse Hemolytic anemia, DIC, rhabdomyolysis
Brown recluse	Increasing pain at site, possible ulceration and necrosis	Local wound care, dapsona to prevent tissue necrosis	
Mammals	etio: <i>pasteurella multocida</i> (MC cats, dogs), S. aureus, S. viridans ± tender lymphadenopathy; local edema, erythema, ↓ ROM (tenosynovitis); pain/swelling at bite, penetrating trauma, depending on size of bite	Saline irrigation, debridement, tetanus and rabies prophylaxis, antibiotics for infection	Infection (staphylococci, Pasteurella multocida, rabies virus)
Human	etio: Staphylococcus > β-hemolytic Streptococci > Eikenella corrodens > Bacteroides; fight injury; pain/swelling at bite, ± tender local lymphadenopathy	Saline irrigation, broad coverage antibiotics, debridement, thorough documentation	High incidence of infection with primary closure or delayed presentation

Critical care

- Shock

Type	defect	CO	PCWP	PVR	Tx
Hypovolemic	↓ preload	↓	↓	↑	IV crystalloid/colloid infusions, blood losses → replace w/ 3:1 rule (3 L fluid:L of blood loss)
Cardiogenic	myocardial failure	↓	↑	↑	Pressors (dobutamine) ± dopamine, ± norepinephrine, oxygen;
Septic	↓ PVR	↑	↓	↓	Norepinephrine (pPx MODS), AB, O2;
Anaphylactic		↑	↓	↓	diphenhydramine; 1:1000 epi;

- Refeeding syndrome - assoc: alcoholism, anorexia nervosa, bariatric surgery, starvation; patho: compartment shifts → hypokalemia, hypomagnesemia, hypophosphatemia; 2° hyperglycemia; Tx: IV minerals, reduce initial kilocalorie by 25%, ✓ glu qid and elements, gradually ↑ kilocalories;
- Transfusion-related acute lung injury (TRALI) - clinic: 2-6 h post transfusion; (similar to ARDS but no ↑ PCWP) hypoxemia, BL pulmonary edema, tachycardia, hypotension; Tx: supportive, ventilation w/ small TV;